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Venomius, a new monotypic genus of Australian orb-weaving spiders (Araneae, Araneidae)

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Abstract

A new monotypic Australian genus in the orb-weaving spider family Araneidae Clerck, 1757 is described, *Venomius* **gen. nov.**, with *V. tomhardyi* **sp. nov.** as type species. Somatically, *Venomius* **gen. nov.** is similar to the typical leaf-curling orb-weaving spiders, such as *Phonognatha* Simon, 1894 or *Leviana* Framenau & Kuntner, 2022, due to a similar elongate cylindrical abdomen and colouration; however, the genital morphology of the new genus is very different. Most unusual are the presence of two strong macrosetae on the male pedipalp tibia. Male pedipalp sclerites are complex, with diagnostic characters including the tibial macrosetae and a keeled median and a rounded basal process on the stipes. The epigyne of females is wholly covered by the scape that has a short median process. *Venomius tomhardyi* **gen. nov. et sp. nov.** has been collected in southern Australia, from Tasmania to Western Australia, where it builds a circular, vertical orb-web. Spiders often hide in silk-lined hollows in branches of trees when disturbed during the day.

Key Words

Australia, systematics, monotypy, taxonomy

Introduction

With 223 described species in 41 genera, the orb-weaving spider family Araneidae Clerck, 1757 is the third-largest spider family in Australia (Framenau 2023), reflecting a similar status world-wide (3,125 species in 189 genera; World Spider Catalog 2023). However, the delimitation of the family and therefore its number of constituent species remain controversial, specifically with respect to its basal clades (Kallal et al. 2020; Kuntner et al. 2023 and references therein).

Like other araneoids, such as the Linyphiidae Blackwall, 1859 and Theridiidae Sundevall, 1833, there is high genus level diversity in the Araneidae, resulting in many genera with a small number of species. Fifteen of the Australian araneid genera include five or less species; of these, four are currently monotypic: *Abba* Castanheira & Framenau, 2023, *Cyrtobill* Framenau & Scharff, 2009, *Lariniophora* Framenau, 2011 and *Quokkaraneus* Castanheira & Framenau, 2022 (see also Castanheira and Framenau 2023a; table 1).

During a recent field trip in southern Australia, we collected a large number of specimens of an unusual species of orb-weaving spiders that did not display the synapomorphies of any of the recently revised genera nor any other genus known to us. Somatic morphology, particularly the somewhat elongate and cylindrical abdomen without any humeral or posterior humps, resembled that of leaf-curling orb-weavers, such as *Phonognatha* Simon, 1894 or *Leviana* Framenau & Kuntner, 2022 (see Kallal and Hormiga 2018; Framenau and Kuntner 2022).

However, genital morphology is vastly different from any of these species and the new species was not observed to include a rolled leaf into its web.

We here propose a new monotypic genus to harbour this unusual species as part of an ongoing revision of Australian Araneidae. Due to its unusual morphology, we are not able to place the species in any of the established subfamilies of orb-weaving spiders or any of the informal clades proposed by Scharff et al. (2020). Documenting this unusual genus here will facilitate its consideration in forthcoming phylogenetic studies of the family and constituent subfamily groupings.

Methods

This study was triggered by specimens collected during our recent fieldtrip targeting orb-weaving spiders in southern Australia, although the new species had already been known from a few records in Australian museums. Overall, this study is based on an examination of more than 12,000 Araneidae records (= vials) as part of an ongoing revision of Australian Araneidae that commenced in 2005.

Descriptions and terminology follow recent publications on Australian Araneidae (e.g., Castanheira and Framenau 2022, 2023a, b; Framenau et al. 2022a). We separated the characters for the genus and species-level descriptions in a manner similar to the studies on the monotypic *Abba*, *Courtaraneus* Framenau, Vink, McQuillan & Simpson, 2022 and *Quokkaraneus* (Castanheira and Framenau 2022, 2023a; Framenau et al. 2022b), i.e. genus-level characters described here are those that were shown to be informative at that level by a previous morphological systematic study on the Araneidae (Scharff and Coddington 1997). Colour patterns were described based on specimens preserved in ca. absolute ethanol.

The male pedipalp was expanded by alternatively submerging it for around 10 min in 10% KOH and distilled water until fully expanded. The terminology of the views of the male pedipalp considers its position as a limb. In Araneidae, the pedipalp is twisted so that the cymbium is situated mesally; therefore, the full view of the bulb with the cymbium in the background is retrolateral. We here recognise two new sclerites on the pedipalp stipes, i.e. a transverse median keel and a basal protrusion. The epigyne was cleared by submerging it for around 10 min in 10% KOH. It has two main parts, the base (encapsulating the internal genitalia) and the scape.

Microscopic photographs were taken at different focal planes with a set-up of a Leica DMC4500 digital camera mounted to a Leica M205C stereomicroscope, and combined using the Leica Application Suite X, v. 3.6.0.20104. All photos were edited and combined to plates with Photoshop CC 2023.

All measurements are given in millimetres. They were taken with an accuracy of one tenth of a millimetre, except for eye and labium measurements taken with an accuracy of one hundredth of a millimetre.

Maps were compiled in the software package QGis v. 3.2.6 Buenos Aires (https://qgis.org/en/site/; accessed 14 July 2023). For specimens collected during our own recent field trip, geographic coordinates were approximated using Google Earth Pro v. 7.3.6.9345 to the nearest tenths of a second of Latitude and Longitude. For other museum specimens, these data were extracted directly from original labels or the registration information, or estimated to the closest minute of Latitude and Longitude in Google Earth Pro.

Abbreviations

Morphology

ALE anterior lateral eyes
AME anterior median eyes
PLE posterior lateral eyes
PME posterior median eyes

Collections

AM Australian Museum, Sydney (Australia)
HBI Harry Butler Institute, Murdoch University, Murdoch (Australia)
QVM Queen Victoria Museum and Art Gallery, Launceston (Australia)
SAM South Australian Museum, Adelaide (Australia)
WAM Western Australian Museum, Perth (Australia)

Taxonomy

Order Araneae Clerck, 1757
Family Araneidae Clerck, 1757

***Venomius* gen. nov.**
https://zoobank.org/484F0327-4F9B-4743-8C32-9001EC24761E

Type species. *Venomius tomhardyi* sp. nov.; by monotypy.

Etymology. The new genus ***Venomius*** is named after the Marvel Comics' character "Venom", created by David Michelinie and Todd McFarlane, whose full first appearance was in "The Amazing Spider-Man #300" (published in May 1988), after an alien symbiote bonded with the character Eddie Brock. This genus-group name is a reference to the head of the character Venom, with conspicuous black spots, that resembles the abdomen of our species, specifically the male holotype (Fig. 1A). The gender of the genus-group name *Venomius* is masculine.

Diagnosis. Somatically, specimens of *Venomius* gen. nov. resemble those of *Phonognatha* due to the similar abdomen shape and colouration of both genera (elongate cylindrical with dark brown to black markings dorsally on paler area) (Figs 1A, B, 3A, B vs Kallal and Hormiga 2018, e.g., figs 12A, 13A, 17A, 20A). However, the genital morphology of *Venomius* gen. nov. is quite different from *Phonognatha*. Males do not have the genital

synapomorphies of *Phonognatha* (i.e., the elongate conductor in which the embolus lies or the lack of a median apophysis; Kallal and Hormiga 2018, p. 1079) nor do females (epigyne without scape and lobed spermathecae). Similarly, the genital morphology is very different to that of *Deliochus* Simon, 1894 and *Artiphex* Kallal & Hormiga, 2022, the other representatives of the Phonognathinae Simon, 1894 (sensu Kallal et al. 2020)/Phonognathidae Simon, 1894 (sensu Kuntner et al. 2023) in Australia.

Within an Australian context, an elongate cylindrical abdomen is also present in *Leviana*, but genital morphology is also very different in this genus. The male pedipalp in *Leviana* has a median apophysis with a basal arch over the radix that carries an internal spur, a proposed synapomorphy of this genus (Framenau and Kunter 2022; p. 107). In contrast, *Venomius* gen. nov. do not have such an arch or spur (Figs 1C, 2A). Female epigynes of *Leviana* have an elongated thin scape (although it is often broken off), but the scape is short and broad in *Venomius* gen. nov. covering the epigyne atrium (Fig. 3C).

We here identify the following characters to diagnose *Venomius* gen. nov.: the male pedipalp has two strong macrosetae on the tibia; a finger-like, long paracymbium (Figs 1E, 2B); a stipes carrying two prominent processes, a median keel and a basal round protrusion (Figs 1C, 2A). The female epigyne is wholly covered by the scape, very broad basally with lateral lobes and a short median process (Figs 3C, 4A).

Description. Medium-sized orb-weaving spiders, with males (ca. TL 5.5–6.4) smaller than females (ca. TL 9.1–11.7). Carapace considerably longer than wide, pear-shaped; colour from orange-brown in males to black in females, cephalic area darker in males (Figs 1A, 3A). Fovea transverse (Figs 1A, 3A). Row of posterior eyes slightly recurved, lateral eyes almost touching; anterior median eyes slightly protruding from the carapace in both sexes (Figs 1A, 3A). Sternum longer than wide, from orange-brown to black (Figs 1B, 3B). Labium wider than long, with anterior pale edge (Figs 1B, 3B). Maxillae with pale antero-mesal section (Figs 1B, 3B). Chelicerae fangs with three promarginal and three retromarginal teeth of similar size. Leg formula I > II > IV > III. Abdomen elongate cylindrical, anteriorly somewhat narrower, without humeral or other humps; three pairs of conspicuous black sigillae (median pair somewhat larger), abdomen otherwise without specialised setae, condyles or other specific structures; dorsally with pale yellow background (coated by three large longitudinal black streaks in males) that expands to a large black patch posteriorly in both sexes (Figs 1A, 3A). Venter brown to black with a pair of two pale spots centrally (Figs 1B, 3B). Male pedipalp patella with a single macroseta (Fig. 1D; only setal socket present basally, macroseta broken off in holotype); tibia with prominent ventral edge and two strong and elongated macrosetae (Figs 1C, E, 2A); tegulum heavily sclerotized, with rounded lobe at its basal dorsal portion (Figs 1C, D, 2B); paracymbium finger-like, very conspicuous (Figs 1C–E, 2B–D); median apophysis strongly sclerotised, canoe-shaped, with a narrow rounded base, a constricted middle portion and a broad concave tip (Figs 1C, D, 2A, B); radix thin and curved (Figs 1C, 2A); stipes with central flattened keel and concave and basal round protrusion (Figs 1C, 2A, B); terminal apophysis flattened with its distal portion elongated, curved dorsally and with truncated tip that covers the base of conductor as a hood (Figs 1C, D, 2A–D); conductor prominent, U-shaped, centrally concave and projected retrolaterally, bearing a rounded protrusion medially connected to an elongate basal lobe, and with scale-like structures covering most of its external margin (Figs 1C, D, 2A, B, D); embolus complex, basally broad, tapering apically with a central, elongate L-shaped keel, with uncapped tip that fits the elongate basal lobe of the conductor (Figs 1C, 2A, B, D). Female epigyne wider than long, scape broad, covering the atrium with narrow projecting lateral borders curving into a short and rounded median lobe that overreaches the epigyne border (Figs 3C–E, 4A); posterior plate triangular tapering to a round prominence (Fig. 3E); internal genitalia formed by two pairs of ovoid spermathecae, copulatory ducts thick and curved, located laterally (Fig. 4A, B).

Distribution. Specimens of *Venomius* gen. nov. have so far been found in northern Tasmania, Victoria, south-eastern South Australia and south-western Western Australia (Fig. 5).

Venomius tomhardyi sp. nov.

https://zoobank.org/9FFC9A30-D7B0-4751-BA8F-DE1DCF6EC0BE

Type specimen. ***Holotype*** male, Launceston, Trevallyn Nature Recreation Area, Stolen Spice Trail, 41°26'33.58"S, 147°05'56.26"E, 10.i.2023, R. Baptista coll. (QVM:2023:13:0100).

Other material examined. AUSTRALIA: **South Australia**: 1 female, Coorong, Sandpiper Campground, 36°08'31.17"S, 139°38'24.15"E (HBI N30487-7); 1 male, Coorong, saltpan near Sandpiper Campground, 36°08'39.09"S, 139°38'22.92"E (HBI N30488-22); 12 females, 15 juveniles, same data (HBI N30488-12). **Tasmania**: 1 female, Bakers Beach, 41°08'35.55"S, 146°36'29.75"E, (QVM:2023:13:0102); 1 female, Launceston, Trevallyn Nature Recreation Area, Stolen Spice Trail, 41°26'33.58"S, 147°05'56.26"E (QVM:2023:13:0101); 1 male, 1 juvenile, Forth Falls, 41°23'S, 146°13'E (AM KS28876). **Victoria**: 2 females, 1 male, Churchill, 38°18'S, 146°25'E (SAM). **Western Australia**: 1 female, Hamersley Inlet Campground, 33°57'29.22"S, 119°54'59.28"E (HBI N30976-32); 1 male, 12 females, same data (HBI N30976-7); 1 male, Meelup Beach, 33°34'23.1"S, 115°05'13.6"E (WAM T73682); 1 male, 1 female, Yangebup Lake, 32°07'S, 115°49'E (WAM T85284).

Etymology. The species epithet is a patronym in reference to the English actor Edward Thomas "Tom" Hardy, who plays the character Eddie Brock and his alter-ego Venom in the super-hero films of the same name.

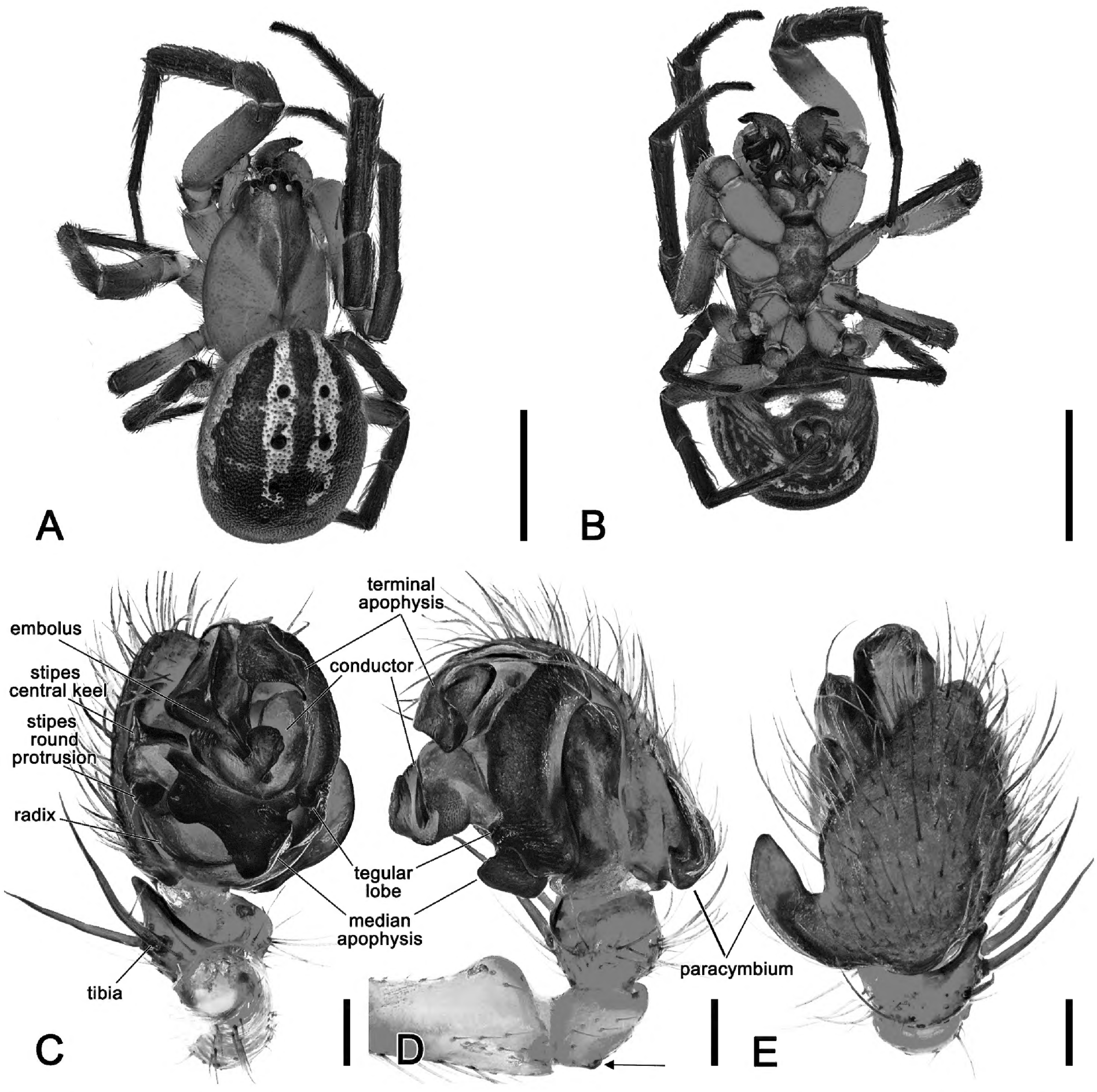

Figure 1. *Venomius tomhardyi* sp. nov., male holotype (QVM:2023:13:0100). **A** dorsal habitus **B** ventral habitus **C–E** left pedipalp: **C** retrolateral view **D** dorsal view **E** mesal view. Scale bars: 2 mm (**A, B**); 0.2 mm (**C–E**). Arrow in **D** points to the setal socket of the patellar macroseta.

Diagnosis. As for genus; *Venomius* gen. nov. is monotypic.

Description. **Male** (based on holotype QVM:2023:13:0100): Total length 5.5. Carapace 2.5 long, 1.9 wide, orange-brown, with cephalic area and fovea mottled dark (Fig. 1A). Row of eyes: AME 0.43, PME 0.37, PLE 0.82. Chelicerae orange-brown (Fig. 1B). Leg femora orange-brown, distally darker; all other segments dorsally and ventrally black (Fig. 1A, B); length of segments (femur + patella + tibia + metatarsus + tarsus = total length): I – 2.2 + 0.5 + 2.0 + 1.8 +1.0 = 7.5, II – 1.2 + 0.8 + 1.4 + 1.0 + 0.9 = 5.3, III – 1.2 + 0.6 + 0.7 + 0.7 + 0.6 = 3.8, IV – 1.7 + 0.7 + 1.0 + 0.8 + 0.4 = 4.6. Labium 0.10 long, 0.40 wide, dark brown, maxillae orange-brown, both anteriorly pale (Fig. 1B). Sternum 1.4 long, 0.8 wide, orange-brown mottled dark (Fig. 1B). Abdomen 3.0 long, 2.5 wide, slightly narrower anteriorly, dorsally with pale yellow background and three large longitudinal black streaks that expand posteriorly to a large black patch, three pairs of small sigillae (Fig. 1A); venter dark brown with a pair of two central pale spots; pale yellow mottled posterior of spinnerets (Fig. 1B). Pedipalp length of segments (femur + patella + tibia + cymbium = total length): 0.5 + 0.3 + 0.2 + 1.0 = 2.0; description as for genus (Figs 1C–E, 2A–D).

Female (based on HBI N30976-7; except for internal genitalia which is QVM:2023:13:0101): Total length 9.1. Carapace 3.4 long, 2.6 wide; entirely black (Fig. 3A). Row of eyes: AME 0.62, PME 0.55, PLE 1.53. Chelicerae black (Fig. 3B). Leg femora dorsally and ventrally yellow; patellae, tibiae, metatarsi and tarsi dorsally and ventrally black in legs I and II, tibiae II slightly lighter; patellae III and IV dorsally dark brown and ventrally yellow; tibiae

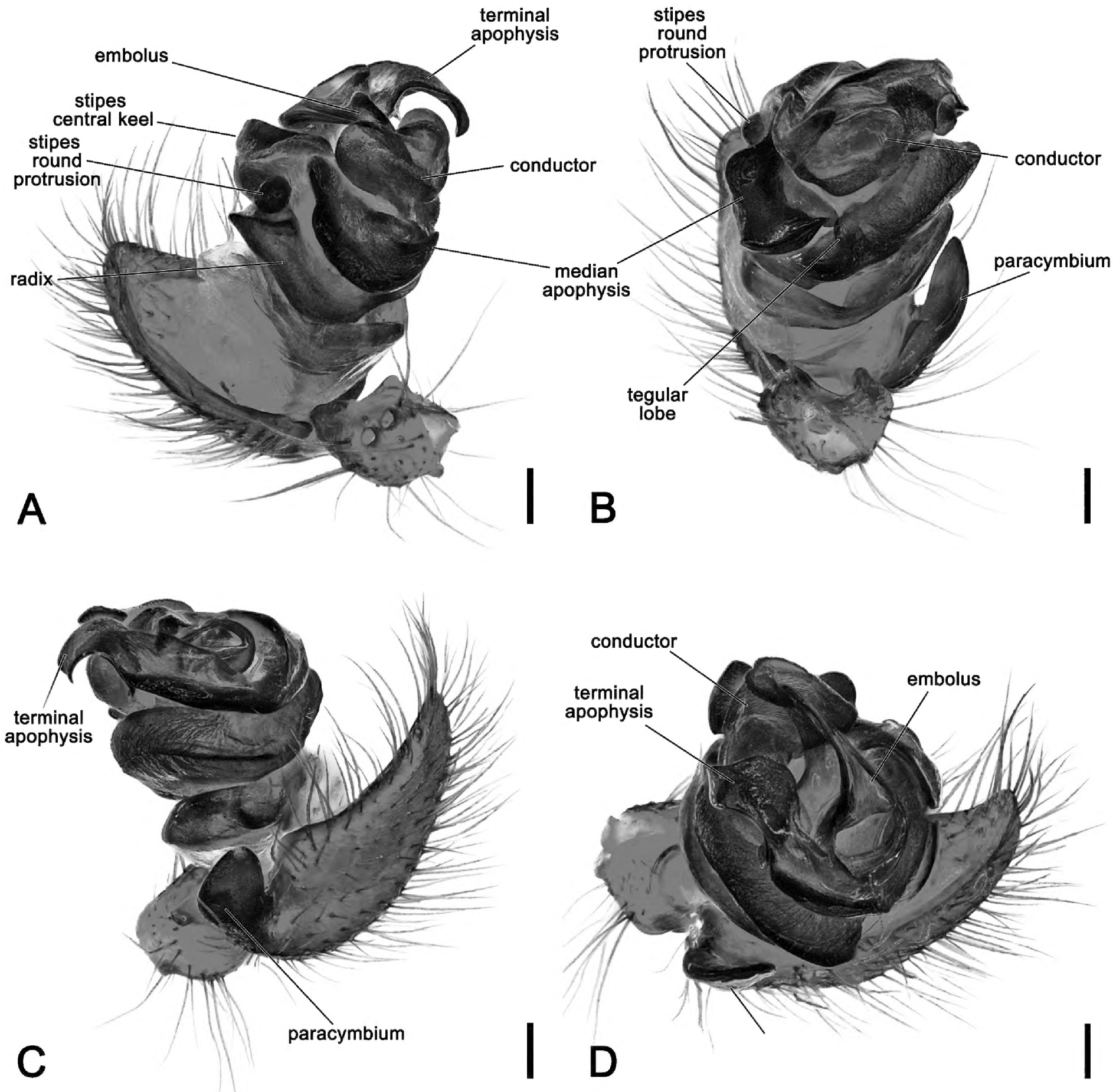

Figure 2. *Venomius tomhardyi* sp. nov., male, expanded left pedipalp (HBI N30488-22). **A** ventral view **B** retrolateral view **C** dorsal view **D** apical view. Scale bars: 0.2 mm.

III and IV dorsally and ventrally yellow; metatarsi III and IV and tarsi III and IV orange brown (Fig. 3A, B). Pedipalp length of segments (femur + patella + tibia + tarsus = total length): 1.0 + 0.4 + 0.8 + 1.0 = 3.2. Leg formula I > II > IV > III; length of segments (femur + patella + tibia + metatarsus + tarsus = total length): I – 3.0 + 1.4 + 2.8 + 3.0 + 1.1 = 11.3, II – 2.0 + 0.9 + 2.5 + 1.8 + 1.2 = 8.4, III – 1.2 + 0.5 + 0.7 + 1.0 + 0.6 = 4.0, IV – 1.8 + 1.0 + 1.6 + 1.1 + 0.7 = 6.2. Labium 0.50 long, 0.90 wide, very dark brown, maxillae black, both anteriorly pale (Fig. 3B). Sternum 2.0 long, 1.2 wide, black (Fig. 3B). Abdomen 5.7 long, 4.1 wide, dorsally with pale yellow background and dark punctuations, combining into a large black patch posteriorly; three pairs of small black sigillae (Fig. 3A), venter olive-grey, laterally orange-brown, centrally with a pair of pale spots (Fig. 3B). Epigyne and spermathecae descriptions as for genus (Figs 3C–E, 4A, B).

Variation. Total length males 5.5–6.4 (n = 3). Total length females 9.1–11.7 (n = 5). Colour varies slightly among specimens, particularly females, with the carapace varying from dark brown to black and the abdominal posterior black field varying in size.

Life history and habitat preferences. There is no clear phenological pattern in the collection data of *V. tomhardyi* gen. nov. et sp. nov. with mature males and females found in October, December, January, April and June.

Most specimens were found in vertical orb-webs at about 1 to 2 m height in bushland or forest habitat, often near the coast. Webs were found at night, most of them on exposed branches of trees, especially on dead branches or fallen trees, but sometimes also near the trunks inside the leaf cover. The webs usually had a signal line connecting its hub to the branches supporting them, sometimes also connected to silk-lined holes in the branches, especially in the

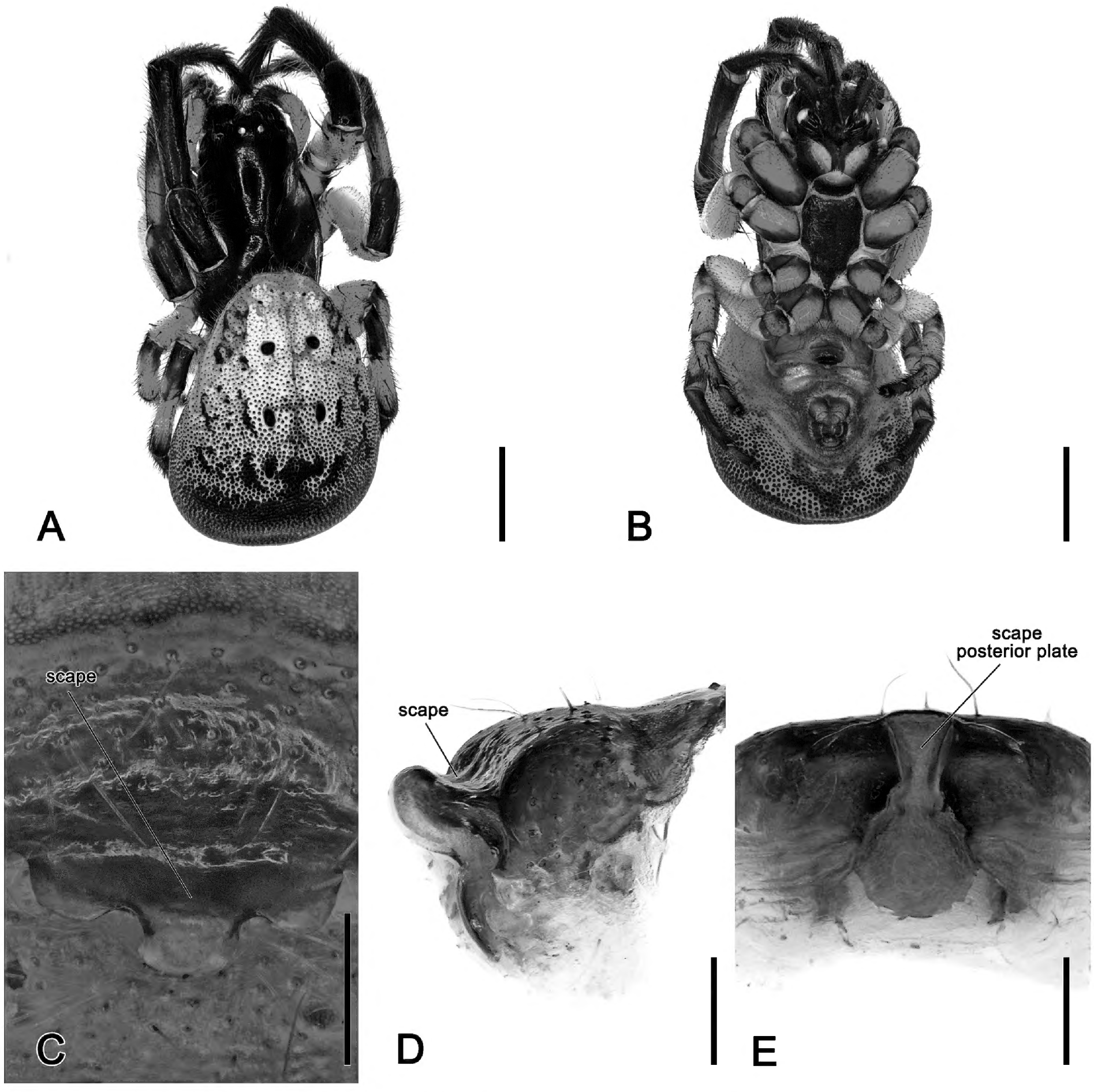

Figure 3. *Venomius tomhardyi* sp. nov., female (HBI N30976-32). **A** dorsal habitus **B** ventral habitus **C** epigyne, ventral view **D** epigyne, lateral view **E** epigyne, posterior view. Scale bars: 2 mm (**A, B**); 0.2 mm (**C–E**).

case of females and big juveniles. When disturbed, the spiders quickly followed the signal line and disappeared into the holes. During the day, spiders were found hiding inside the holes or on tree branches after they absorbed the web. Males were spotted at the silk scaffolding of female webs at night (RLCB pers. obs., John Douglas pers. comm.).

Distribution. As for the genus, which is monotypic (Fig. 5).

Discussion

This paper constitutes a further contribution to an ongoing revision of the Australian orb-weaving spiders in the family Araneidae (for a summary on previous studies see Castanheira and Framenau 2023a; table 1). *Venomius tomhardyi* gen. nov. et sp. nov. represents the fifth monotypic species of the family in the country, although it must be considered that the four subspecies of *Austracantha minax* (Thorell, 1859) should be considered synonyms of the nominal species (VWF, N. Scharff unpublished data). Similar to recent descriptions of other monotypic araneid genera in Australia (Framenau and Scharff 2009; Framenau 2011; Castanheira and Framenau 2022, 2023a), we only made the decision to describe this genus after careful consideration and based on an extensive examination of araneid material in Australian and overseas collections. It is evident that *V. tomhardyi* gen. nov. et sp. nov. does not share the synapomorphies of any described Australian genus. Its highly derived characters, e.g., the presence of two tibial macrosetae, the unique median keel and basal protrusion on the stipes, and the

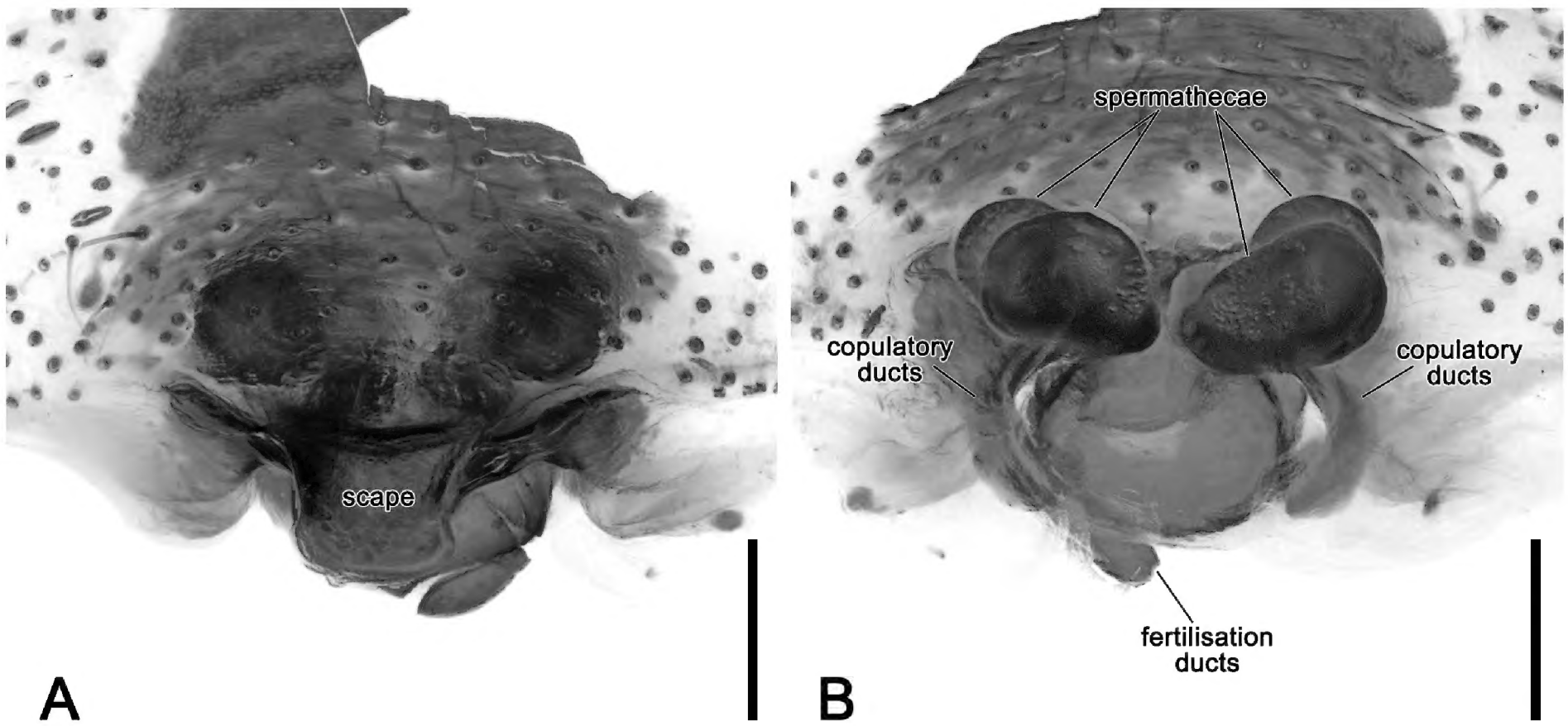

Figure 4. *Venomius tomhardyi* sp. nov., female internal genitalia (QVM:2023:13:0101). **A** ventral view **B** dorsal view. Scale bars: 0.2 mm.

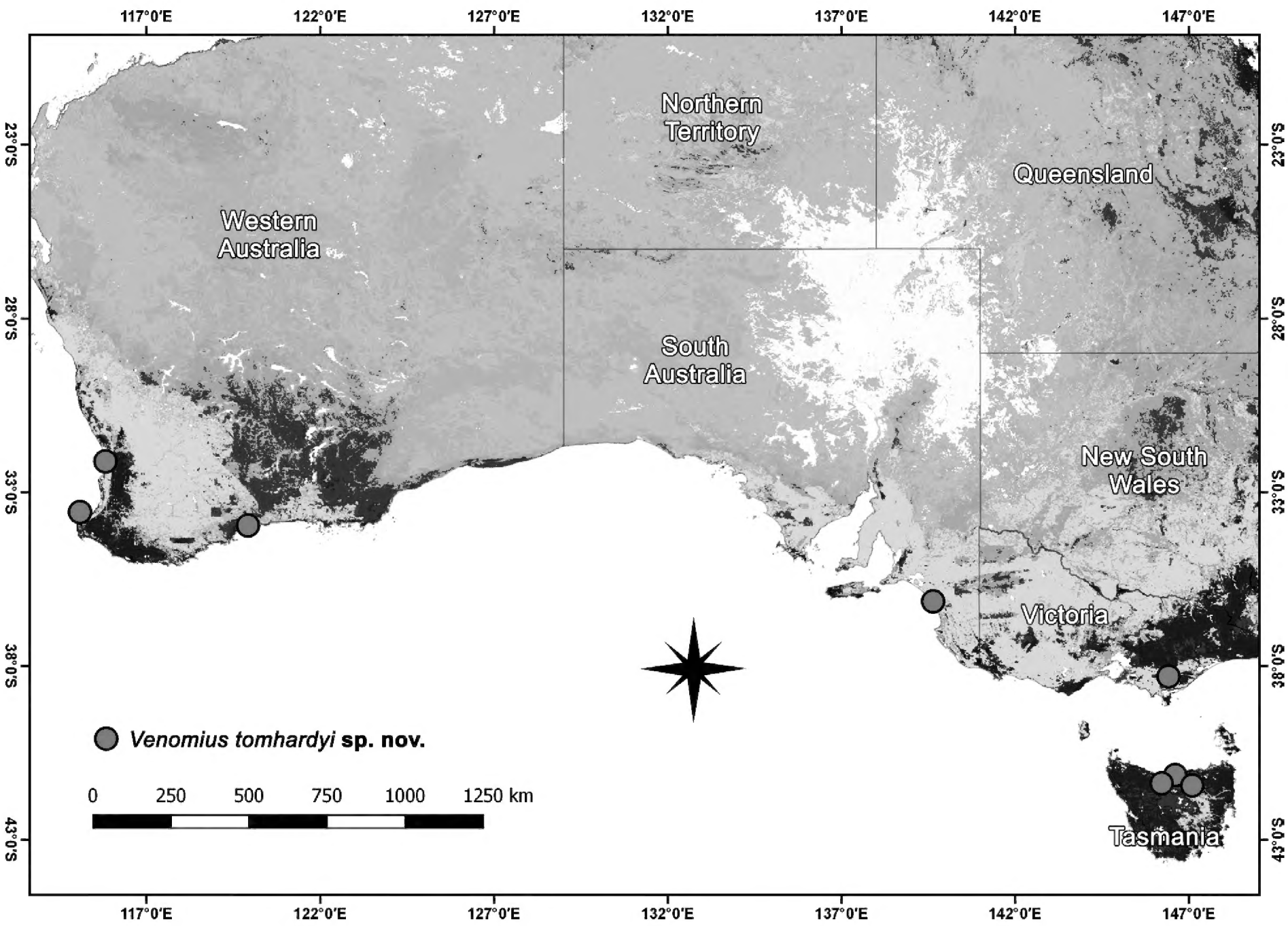

Figure 5. Distribution records of *Venomius tomhardyi* sp. nov.

unique shape of the female epigyne justify the erection of a new genus for this species and will improve its diagnosability in future keys of Australian orb-weaving spiders.

Tibial modifications of the male pedipalp are rare in araneids and Scharff and Coddington's (1997) preliminary morphological phylogenetic study did not consider any character in relation to this segment. The tibia of *V. tomhardyi* gen. nov. et sp. nov. carries two large macrosetae and has a pronounced apical keel (Fig. 1C). We only know of one araneid with tibial modifications, the New Zealand *Courtaraneus orientalis* (Urquhart, 1887), which has two complex, basally articulated tibial apophyses that may be considered homologous to the macrosetae in *V. tomhardyi* gen. nov. et sp. nov. However, pedipalp

structure and somatic morphology of *C. orientalis* are otherwise very different to that of *V. tomhardyi* gen. nov. et sp. nov. and a close relationship of both genera is otherwise not supported. We will explore the phylogenetic relationships of these two genera in an upcoming molecular phylogenetic study with focus on Australasian orb-weaving spiders.

The presence of an elongate cylindrical abdomen is a common feature of leaf-curling araneids in both the Phonognathidae/Phonognathinae (Kallal and Hormiga 2018) and 'backobourkiines' sensu Scharff et al. (2020) (Framenau and Kuntner 2022). It may be an adaptation to the restricted space in the spiders' retreat. Clearly, the presence of abdominal humps or other shape modifications providing camouflage in many other araneids do not offer any advantages in leaf-curling spiders and would be a hindrance. *Venomius tomhardyi* gen. nov. et sp. nov. is somatically similar to leaf-curling spiders but these spiders do not include a leaf retreat in the web. However, we observed that these spiders often occupy a silk-lined hole in the branches to which they attached their webs, a behaviour similar, for example, to members of the genus *Paramatachia* Dalmas, 1918 in the family Desidae Pocock, 1895 who occupy vacated hollows of woodboring insects (Marples 1962; Hickman 1967). We hypothesise that the abdominal shape of these orb-weaving spiders in these circular retreats provides similar advantages to that of leaf-curling spiders and that the abdominal shape in these species is based on convergent evolution in at least three different araneoid lineages.

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